

REMARKS

Claims 1-67 are now pending in this application. Claims 68-110 have been canceled. Claims 1-67 stand rejected.

Claims 1-7, 11, 12, 17-21, 23, 24, 28-34, 37, 41-45, 47-53, 56, 57 and 62-66 stand rejected under 35 § U.S.C. 103(a) as being unpatentable over Ohsawa et al., "Memory design using a one-transistor gain cell on SOI" (IEEE 2002)("Ohsawa") in view of Pham et al. (U.S. Patent No. 6,838,322)("Pham"), and further in view of U.S. Patent No. 6,313,486 to Kencke et al. The rejection is respectfully traversed.

Independent claim 1 recites a memory device comprising, *inter alia*, a "storage transistor comprising: a body portion between first and second source/drain regions," each "including a plurality of layers capable of generating carriers through impact ionization," and "a gate structure, wherein the gate structure wraps at least partially around the body portion."

Independent claim 23 recites a "dynamic random access memory (DRAM) cell" comprising, *inter alia*, a "storage transistor comprising: a body portion between first and second source/drain regions, the body portion containing a heavily doped region of a first conductivity type adjacent to the second source/drain region and separated from the first source/drain region" and "a gate structure, the gate structure wrapping at least partially around the body portion in at least two spatial planes."

Independent claim 28 recites a "memory array" comprising, *inter alia*, "a plurality of memory cells, each memory cell comprising a storage transistor," the storage transistor comprising a "body portion containing a heavily doped region of a first conductivity type adjacent to [a] second source/drain region and separated from [a] first source/drain region," the storage transistor further comprising "a plurality of

gates at least partially surrounding the body portion.” Likewise, independent claim 47 recites a “transistor device” comprising, *inter alia*, “a body portion for storing charge, . . . the body portion including a doped region of a second conductivity type adjacent to the second source/drain region and separated from the first source/drain region” and “a gate structure wrapping around the body portion in at least two spatial planes.”

Independent claim 30 recites a “semiconductor chip” comprising, *inter alia*, “a plurality of dynamic random access memory (DRAM) cells, at least one DRAM cell comprising a partially depleted storage transistor” having “first and second source/drain regions including a plurality of layers capable of generating carriers through impact ionization” and “a gate structure, the gate structure wrapping at least partially around each fin-shaped structure.”

Independent claim 32 recites a processor system comprising, *inter alia*, a “storage transistor comprising: a body portion between first and second source/drain regions,” each “including a plurality of layers capable of generating carriers through impact ionization,” and “a gate structure, wherein the gate structure wraps at least partially around the body portion.”

Independent claim 47 recites a “transistor device” comprising, *inter alia*, “a body portion for storing charge, . . . the body portion including a doped region of a second conductivity type adjacent to the second source/drain region and separated from the first source/drain region” and “a gate structure wrapping around the body portion in at least two spatial planes.”

As acknowledged by the Office Action of January 4, 2006, at page 3, Ohsawa does not teach or suggest a gate structure wrapping around a body portion or a plurality of gates. Ohsawa teaches memory based on a one-transistor gain cell. In

order to accomplish Ohsawa's one-transistor gain cell, a planar MOSFET with an electrically floating body is used. Ohsawa at p. 1510, Section II. Pham, on the other hand, teaches a fabrication process for forming a FinFET.

Neither Pham nor Ohsawa makes any reference, mention, or suggestion that it is possible to use Pham's FinFET as a storage device. Applicant respectfully submits that this rejection is based improperly on hindsight.

It is understood by those skilled in the art that FinFETs provide very good gate control in the sub-threshold and linear regions. FinFETs allow use of an undoped channel and can be fully depleted devices. As mentioned in Pham, when planar devices are scaled, intense channel doping is needed. However, the channel doping degrades carrier mobility and junction characteristics. Pham at col. 1, lines 25-34. Also, the fabrication processes described by Pham do not include channel doping.

Pham has not suggested that the disclosed FinFET could be for use as a storage transistor. The claimed storage transistor uses a substantial floating body effect in its operation; Pham does not discuss how the described FinFET may be used as a storage device, or how the FinFET is in any other way suited for use in a memory cell. The constraints required for a conventional FinFET are very different from the constraints required for constructing a storage device. Applicants found that a FinFET could be used as a storage device by suitably doping source/drain regions, but the Office Action has not shown any motivation in the prior art at the time the invention was made where a FinFET or other structurally similar transistor is similarly employed as a storage device.

"The showing of motivation to combine must be clear and particular, and it must be supported by actual evidence." *Teleflex, Inc. v. Ficosa North America Corp.*,

299 F.3d 1313, 1334 (Fed. Cir. 2002), citing *In re Dembiczak*, 175 F.3d at 999. "Broad, conclusory statements regarding the teaching of the multiple references, standing alone, are not 'evidence.'" *In re Dembiczak*, 175 F.3d at 999.

While the Office Action is correct that "any judgment on obvious is in a sense necessarily a reconstruction based upon hindsight, the Federal Circuit requires a "rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." *McGinley*, 262 F.3d at 1351; *In re Dembiczak*, 175 F.3d at 999. This is required because "[t]he genius of invention is often a combination of known elements which in hindsight seems preordained. " *McGinley*, 262 F.3d at 1351; *In re Dembiczak*, 175 F.3d at 999.

This "rigorous application" is "the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis." *In re Dembiczak*, 175 F.3d at 999; "To prevent hindsight invalidation of patent claims, the law requires some teaching, suggestion or reason to combine cited references." *McGinley*, 262 F.3d at 1351. "When the art in question is relatively simple . . . the opportunity to judge by hindsight is particularly tempting. Consequently, the tests of whether to combine references need to be applied rigorously." *Id.*

At the same time, "as a 'useful general rule,' . . . references that teach away [from a particular combination] cannot serve to create a prima facie case of obviousness." *McGinley*, 262 F.3d at 1353-4, citing *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). The Federal Circuit has also held that a modification that produces a "seemingly inoperable device" necessarily teaches away from that modification. *McGinley*, 262 F.3d at 1354, citing *In re Sponnoble*, 405 F.2d 578, 587 (CCPA 1969); *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984).

Pham teaches away from Applicant's invention as to the combination of the FinFET of Pham with Ohsawa would create a "seemingly inoperable device" because the changes proposed by the Office Action, for example, the intense channel doping needed to convert the FinFET of Pham into a storage device, would destroy the ability of the FinFET of Pham to operate as contemplated by the Pham disclosure, i.e., employing an undoped channel for its desired carrier mobility and junction characteristics.

This modification is not merely "inferior," as suggested by the Office Action, but results in a completely inoperable device. *In re Gurley*, cited by the Office Action at page 6, therefore does not apply, because it relates only to situations where a configuration is disclosed, yet described as undesirable. In this instance, the claimed configuration is *not* disclosed, and to modify the prior art as described by the Office Action would render the resulting device inoperable. Therefore, Pham teaches away from Applicant's invention as a matter of law.

Kencke does not cure the deficiencies of Pham or Ohsawa. Kencke is relied upon to illustrate "generating carriers through impact ionization," and source/drain regions comprising "layers of $\text{Si}_x\text{Ge}_{1-x}$ and $\text{Se}_y\text{Ge}_{1-y}$ with different band gaps" but fails to address any of the underlying flaws in the combination of Pham and Ohsawa, discussed in depth above. There is also no motivation to combine the impact ionization feature of Kencke with the device of Pham, Ohsawa, or both.

The Office Action argues at page 4 "Applicant has not established the criticality of the [Si and Ge] doses stated," and therefore, it would have been obvious to combine Kencke's disclosure of $\text{Si}_x\text{Ge}_{1-x}$ and $\text{Se}_y\text{Ge}_{1-y}$ with Pham and Ohsawa. Applicant disagrees. The burden is on the PTO to provide a motivation to combine these references. There is no obligation for the Applicant to establish that these

proportions represent a critical dose; this limitation does not establish any specific “dose” of either material, or even a range of doses, but rather a variable relationship between the Silicon and/or Germanium content of the layers, i.e. “layers of $\text{Si}_x\text{Ge}_{1-x}$ and $\text{Se}_y\text{Ge}_{1-y}$ with different band gaps.” In any event, the advantages of employing Silicon and Germanium in these proportions are explained at page 15 of Applicant’s specification.

For at least these reasons withdrawal of this rejections of claims 1, 23, 28, 30, 47 and all dependent claims is respectfully requested.

Claims 8 and 35 stand rejected under § 103(a) as being unpatentable over Ohsawa in view of Pham and Kencke, as applied to claim 1, and further in view of Hu et al. (U.S. Patent No. 5,448,513)(“Hu”). The rejection is respectfully traversed.

Claim 8 depends from claim 1 and claim 35 depends from claim 32. Claims 8 and 35 each further recite that “the body portion contains a heavily doped region of a second conductivity type adjacent to the second source/drain region and separated from the first source/drain region.”

As discussed above, Ohsawa, Pham and Kencke fail to teach or suggest the limitations of claims 1, 8, 32 or 35. Hu does not supplement the deficiencies of Ohsawa, Pham and Kencke. The Office Action uses the buried word line 16 of Hu as the “heavily doped region” for the purposes of the claim, but ignores the fact that the heavily doped region is contained within the body portion and is a distinct element from the word line of the claimed invention of claims 8 and 35. There is no motivation to insert the word line of Hu as an element of the claimed transistor *in addition to* the existing word line of the claimed transistor. For at least these reasons, withdrawal of this rejection is respectfully requested.

Claims 14-16, 38-40, and 59-61 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohsawa in view of Pham and Kencke, as applied to claim 1, and further in view of Matsumoto et al. (U.S. Patent No. 6,806,537)("Matsumoto"). The rejection is respectfully traversed.

As discussed above, Ohsawa, Pham and Kencke fail to teach or suggest all limitations of independent claims 1, 32 and 47. Matsumoto does not supplement the deficiencies of Ohsawa, Pham and Kencke, and is cited for teaching a silicide contact in a bipolar transistor. For at least these reasons, Applicant respectfully requests the withdrawal of this rejection.

Claims 15 and 58 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohsawa in view of Pham and Kencke, as applied to claim 1, and further in view of Takasu (U.S. Patent No. 5,307,305). The rejection is respectfully traversed.

As discussed above, Ohsawa, Pham and Kencke fail to teach or suggest all limitations of independent claims 1 and 47. Takasu does not supplement the deficiencies of Ohsawa, Pham and Kencke, and is cited for teaching an insulating material with a high dielectric constant. For at least these reasons, Applicant respectfully requests the withdrawal of this rejection.

Claims 9, 10, 27, 36, 54, and 55 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohsawa in view of Pham and Kencke, as applied to claim 1, and further in view of Yu et al. (U.S. Patent No. 6,221,724)("Yu"). The rejection is respectfully traversed.

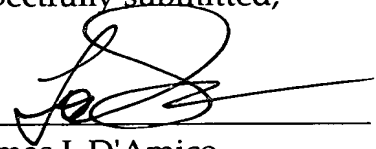
As discussed above, Ohsawa, Pham and Kencke fail to teach or suggest all limitations of independent claims 1, 23, 32 and 47. Yu does not supplement the deficiencies of Ohsawa, Pham and Kencke, and is cited for teaching an inert dopant in a channel region of a transistor. For at least these reasons, Applicant respectfully requests the withdrawal of this rejection.

The Office Action rejects Applicant's arguments based on a boilerplate statement in Pham that states "the invention is not limited to any particular type of integrated circuit," (see page 6-7 of Office Action) but ignores the fact that the specific modifications proposed by the Office Action will result in an inoperable device. Applicant respectfully submits that the outstanding rejections are improper and that the claims should be allowed.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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